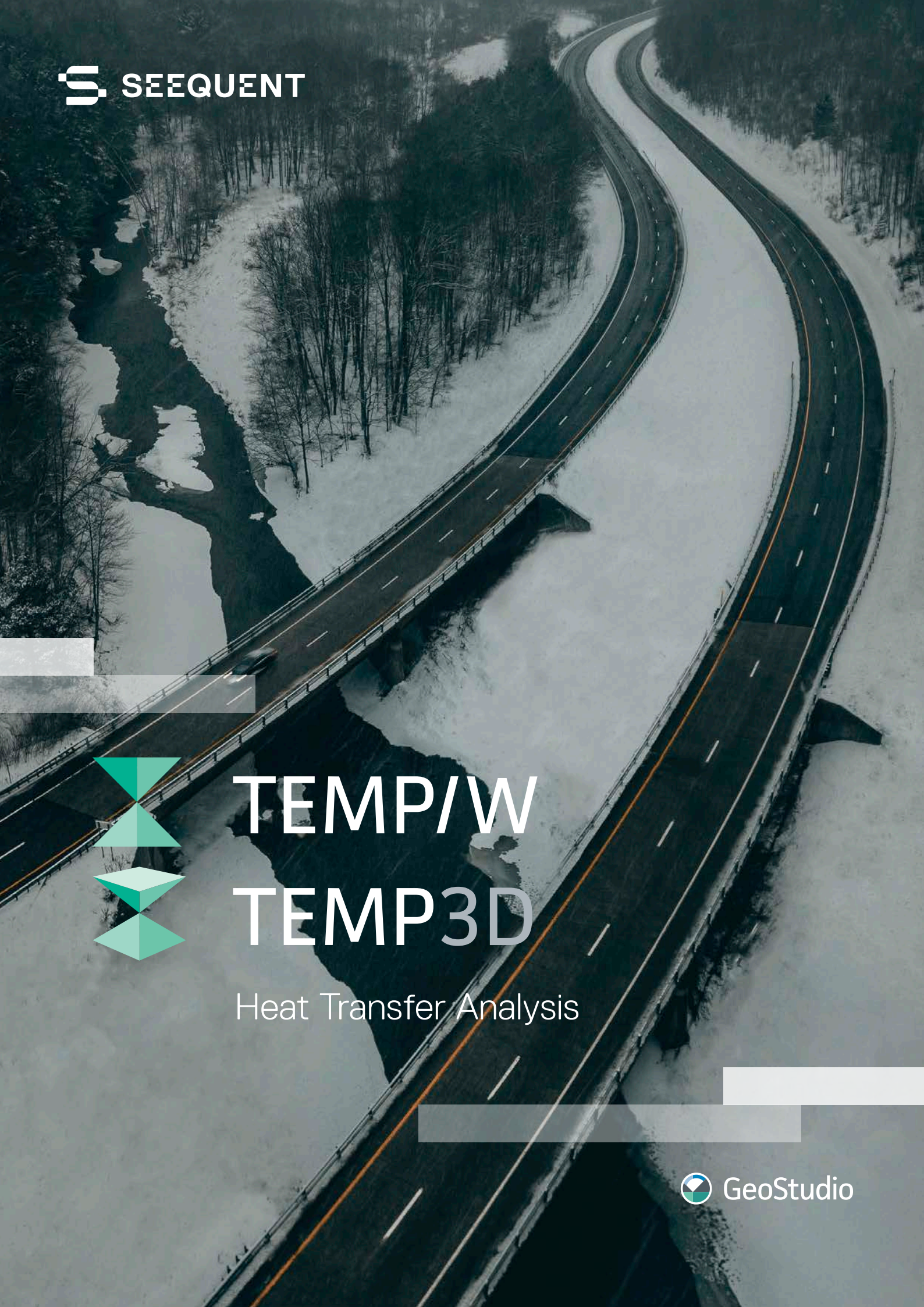
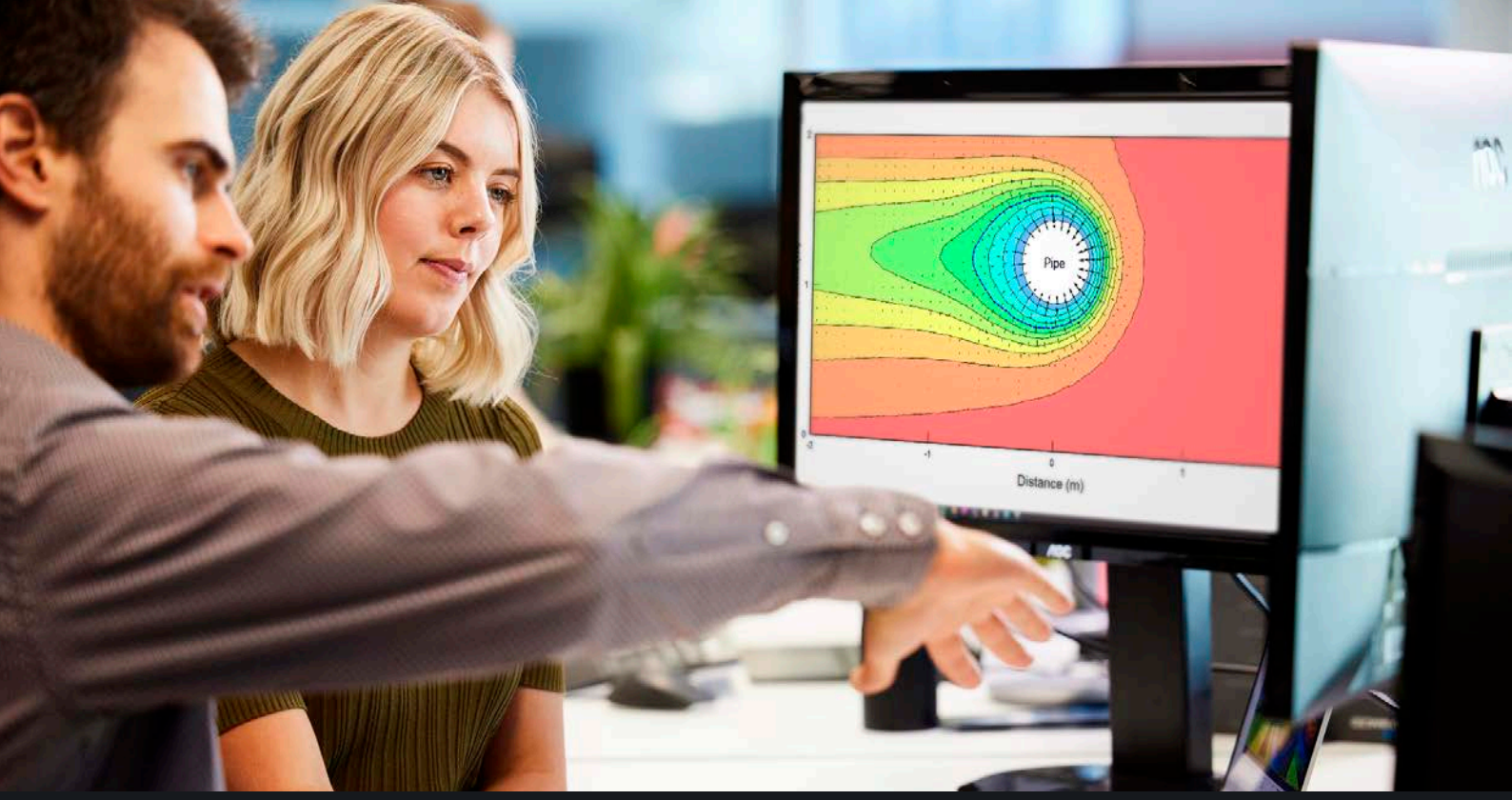

SEEQUENT
TEMP/W
TEMP3D
Heat Transfer Analysis
GeoStudio



TEMP/W is a powerful finite element software product for modeling heat transfer and phase change in porous media. TEMP/W can analyze simple conduction problems to complex surface energy simulations with cyclical freeze-thaw.

Add TEMP3D to TEMP/W to analyze 3D heat transfer using the same comprehensive set of material models and boundary conditions.

Boundary Conditions

TEMP/W and TEMP3D offer a range of boundary condition options, including a rigorous thermosyhpon boundary condition. The convective heat transfer boundary condition allows for simulation of artificial ground freezing or other processes involving the fluid flow over a bounding surface.

Integration

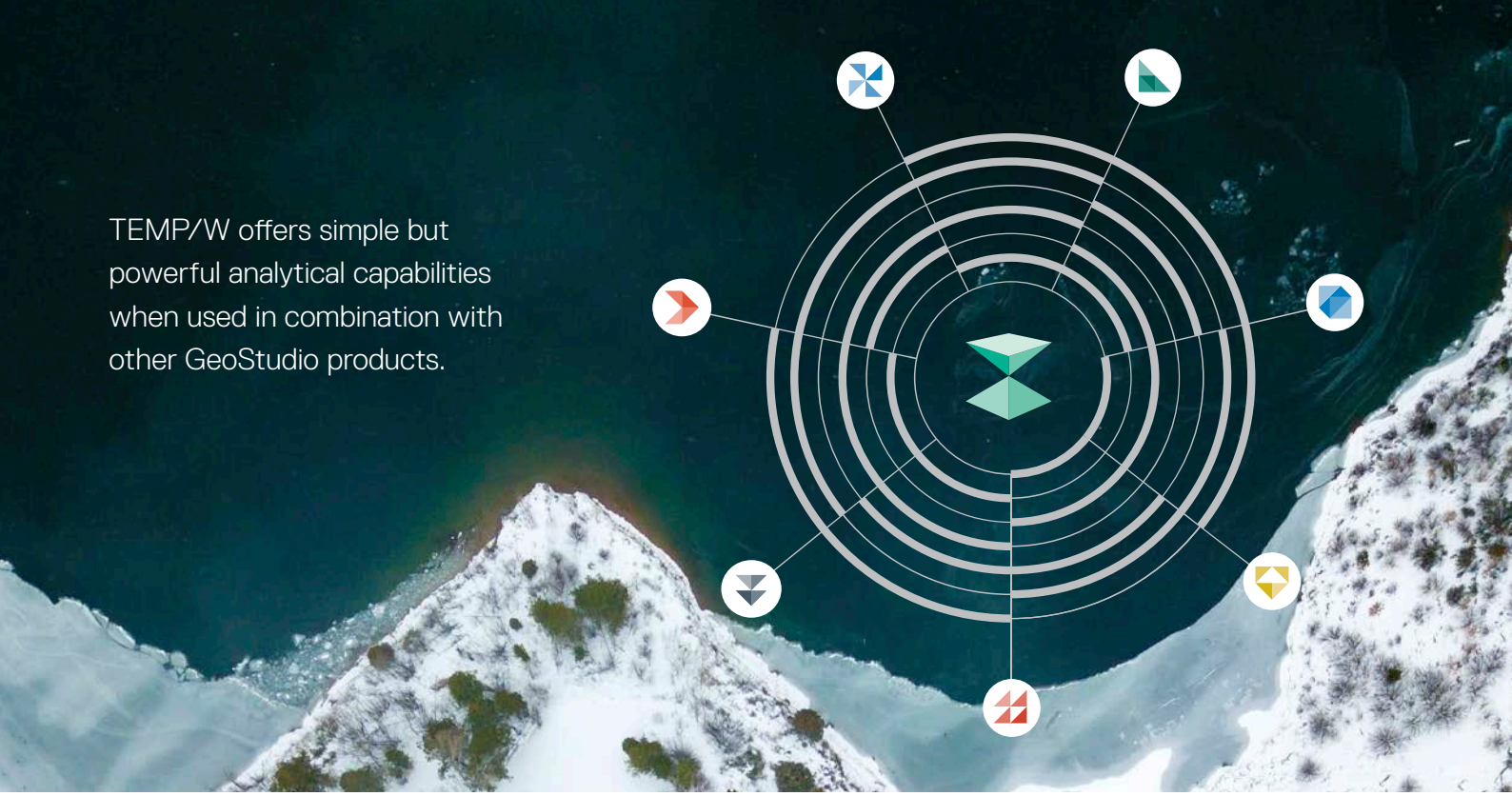
Heat transfer is often governed by forced convection in natural hydrogeological systems. TEMP/W can be fully-integrated with SEEP/W and AIR/W to analyze heat transfer via groundwater flow or air flow, respectively. Integration of TEMP3D, SEEP3D, and AIR3D is also available.

Material Properties

Thermal functions defining the material properties for saturated-unsaturated soils can be estimated using built-in functions. The rigorous phase change formulation provides an accurate solution to problems involving freeze-thaw of saturated-unsaturated porous media.

Land-Climate Interactions

Analyse problems that involve a coupling between climatic conditions and the thermal response within the ground in TEMP/W using the surface energy balance boundary condition.



TEMP/W offers simple but powerful analytical capabilities when used in combination with other GeoStudio products.

Integrated water transfer with SEEP/W+SEEP3D

Density-dependent fluid flow forms when temperature variations cause significant density differences. Fluid movement in turn influences the temperature distribution throughout the domain. A coupled TEMP/W+TEMP3D and SEEP/W analysis allows for the simultaneous simulation of heat and water movement associated with density-dependent flow.

Integrated air transfer with AIR/W

TEMP/W and TEMP3D can use the air fluxes from AIR/W to model forced-convection heat transfer. TEMP/W and TEMP3D can also be integrated with AIR/W and AIR3D to model density-dependent air flow.

Integrated heat, water and gas transfer

Water, energy and gas transfers within the unsaturated zone are often complex and inter-related processes. TEMP/W coupled with SEEP/W and CTRAN/W can simulate these processes and provide insight on vadose zone hydrology. TEMP3D can also be integrated with SEEP3D and CTRAN3D to simulate these processes in 3D.

TEMP/W models a full range of heat transfer problems

Design of ground freezing systems

Controlling groundwater flow and stabilizing ground is critical in many tunnelling, waste management, and civil engineering projects. The convective surface and thermosyphon boundary conditions in TEMP/W+TEMP3D can be used to analyze and design ground freezing systems in porous media. Combined with SEEP/W+SEEP3D and AIR/W+AIR3D, forced-convection heat transfer can be analyzed in even the most challenging physical systems.

Effect of climate change on infrastructure

TEMP/W is used worldwide to analyze the effect of climate change on infrastructure located in northern regions. The sophisticated surface energy balance boundary condition models the exchange of thermal energy at the ground surface for a breadth of climatic and ground cover conditions. The rigorous phase change formulation provides an accurate solution to problems involving freeze-thaw of saturated-unsaturated porous media.

Design of waste cover systems

Cover systems for mine waste, landfills, and mine reclamation in northern regions often involve complex thermal and hydraulic behaviour that effect long-term performance of these structures. TEMP/W+TEMP3D provides the ideal tool for understanding the thermal response of saturated-unsaturated cover systems and may be combined with SEEP/W+SEEP3D and CTRAN/W+CTRAN3D to analyze moisture and solute movement in seasonally frozen systems.

Snow melt infiltration

In seasonally frozen environments, snowmelt is typically the dominant water input to a watershed. Infiltration into frozen ground has a significant impact on run-off and the behaviour of engineered systems. Thus, understanding snowmelt infiltration is critical to managing water movement in agricultural and engineered systems. TEMP/W can be used to simulate snowmelt and the corresponding infiltration into the ground.

TEMP/W and TEMP3D comprehensive feature set

- Comprehensive formulation, including phase change
- Rigorous under-relaxation and convergence strategies
- Thermal functions estimation
- Complete range of boundary conditions
- Steady-state or transient flow formulation
- Convenient initial condition definition
- Surface energy balance capabilities
- Forced convection with water, air, and vapor transfers
- Powerful results graphing
- Use BUILD3D for complex 3D geometry creation
- Parallel solvers easily solve simple 1D to complex 3D analyses
- Export results from TEMP3D for use in other programs, such as Python

Try GeoStudio for free

geoslope.com/learning/downloads/trial

GeoStudio is the leading suite of geo-engineering software used in over 100 countries for the last 40 years. Join thousands of practising engineers, scientists, regulators, professors and students, and start using GeoStudio today.

PROFESSIONAL TECHNICAL SUPPORT | PRODUCT UPDATES
COMPREHENSIVE DOCUMENTATION | HUNDREDS OF EXAMPLE PROBLEMS
ONLINE VIDEO TUTORIALS | PUBLIC WORKSHOPS | ON-SITE TRAINING

GeoStudio

SEEQUENT

FROM COMPLEXITY TO CLARITY

seequent.com | geoslope.com